SECTION 60

HOT WATER HEATING SYSTEM DISTRIBUTION

17 60.1 REFERENCES

18 (60A) UNITED STATES PUBLIC HEALTH SERVICE (USPHS) - *Handbook on*
19 *Sanitation Of Vessel Construction*

20 (60B) CENTER FOR DISEASE CONTROL (CDC) - *Recommended Shipbuilding*
21 *Construction Guidelines for Cruise Vessels To Call on U.S. Ports*

60.2 INTRODUCTION

The Section contains the Contractor Design and Provide general requirements for the hot water heating system.

For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.

60.3 GENERAL

A complete hot water heating system shall be provided to heat the HVAC System Heaters and Potable Water Heaters, and to provide heat to the Main Engine Jacket Water Keep-warm Systems.

The hot water heating system shall consist of two (2) circulating pumps, Main Engine jacket water heat exchangers, an Oil-fired Hot Water Heater, and an Electric Hot Water Heater, together with necessary piping, valves, strainers, controls and instrumentation. Each circulating pump shall be capable of meeting the demands of the entire system.

See Section 73 of the Technical Specification for the general requirements for pumps. General piping and material requirements shall be in accordance with Section 74 of the Technical Specification. Thermal expansion of the piping shall be compensated for by bends, offsets and/or expansion joints.

Thermal insulation shall be in accordance with Section 75 of the Technical Specification. See Section 91 of the Technical Specification for additional requirements.

60.4 HOT WATER HEAT SOURCE OF SUPPLY

The hot water heating system shall be supplied from three (3) sources:

1. Two (2) Main Engine Jacket Water Heats
2. One (1) Oil-fired Hot Water Heater
3. One (1) Electric Hot Water Heater

Waste heat from the Main Engine jackets shall be the primary source of heat, supplemented automatically by the Oil-fired Hot Water Heater. The Electric Hot Water Heater is the backup heat source. The Oil-fired and Electric Hot Water Heaters are described in Section 61 of the Technical Specification.

The hot water heating system shall be designed for 180F degree hot water with a 20F degree temperature drop across the heating coils. The system shall be sized utilizing a 70%-30% water-glycol solution for freeze protection.

Provide and install a non-chemical type water treatment device in the Hot Water Heating System to prevent internal corrosion. The device shall be an ELYSATOR Type T100, complete with flowmeter, air vent, conductivity meter, anode set, inlet/outlet ball valves, and regulating valve (supplied by INTERNATIONAL WATER TREATMENT NORTH AMERICA LLC, 7406-27th St. W #207, University Place, WA 98466, (253) 566-1438), or equal. The device operates in bypass of the hot water system circulating pumps. Provide a flow restrictor in the main piping, if necessary, to create the pressure drop required to cause the required flow through the water treatment device. At commissioning, adjust the flow rate through the unit to approximately ten (10) liters/minute. The Contractor shall consult with the device supplier for exact sizing, maintenance clearance, and installation requirements after determination of the water volume in the hot water system. See the *Hot Water Heat Source Of Supply* Subsection in Section 59 of the Technical Specification.

60.5 HOT WATER DISTRIBUTION SYSTEM

The hot water heating system shall be a two-pipe direct return type system. Hot water shall be circulated by two (2) pumps and piping as required to serve each unit heater, convector, pre-heater, re-heater, the Potable Water Heaters, and the Main Engine Jacket Water Keep-warm Heaters. The pumps shall be arranged to operate as primary/standby with automatic starting of the standby pump on failure or under capacity of the primary pump. The pressure display shall be located on a gage board in a location within the EOS as approved by the WSF Representative. The pushbutton operators and indicators shall be located on the EOS Control Console in a location approved by the WSF Representative. See the *GENERAL* Subsection in Section 85 of the Technical Specification.

The hot water heating system shall be arranged in zones as follows so that in moderate and warm temperatures the system may be operated at reduced capacity with selected zones valved out. The zone valves shall be ball-valve type and arranged in two (2) manifolds in the Engine Room No. 2. One (1) valve manifold shall be for "supply" and the other shall be for "return". ***It is WSF's intent to be able to isolate any zone from these manifolds by closing the supply and return manifold root valves***. The lines from the return manifold shall also be equipped with balancing valves for each zone so that circuit flow may be proportioned according to heat requirements. The valves shall be set at commissioning for optimum flow to each zone. See the *VALVES, FITTINGS AND INSTRUMENT PIPING* Subsection in Section 74 of the Technical Specification for balancing valve indication requirements.

1. Pilothouse level, End No. 1
2. Pilothouse level, End No. 2
3. Crew Accommodation Block Space Heaters, End No. 1
4. Crew Accommodation Block Space Heaters, End No. 2
5. Passenger Deck

6. Engine Room Hold Level, End No. 1
7. Engine Room Hold Level, End No. 2
8. EOS Deck level
9. Auxiliary Machinery Space Heaters
10. Main Engine Jacket Water Heaters
11. Potable Water Heaters

NOTE: ***Pilothouse level*** includes each Pilothouse proper, and its adjoining Ship's Office, Master's Stateroom ,and/or restrooms on the Navigation Bridge Deck level. This area, on each End, shall be serviced by a fan room on that end of the Sun Deck.

The ***Crew Accommodation Block Space Heaters End No. 1 and No. 2*** areas include the cleaning gear lockers and fan rooms on the Sun Deck for it's respective End.

The ***Passenger Deck*** zone includes the Unisex Restrooms on the Sun Deck for both Ends of the Vessel.

A high level of system isolation shall be provided with **all** zones provided with readily accessible isolation stop valves. Local system isolation control valves at air handlers and duct heating coils shall be of the motorized type, and shall be operable from the HVAC control panel in the EOS as described in Section 12 of the Technical Specification.

60.6 TANK HEATING COILS

Hot water heating coils shall be provided in the bottom of the Oily Water Holding Tank and Used Oil Tank to allow the tank contents to be heated for pumping and oil/water separation. The heating coil in each tank shall be formed from two (2) inch, 90-10 copper-nickel, MIL-T-16420, Class 200, ASTM B466 tubing. Each coil shall be a serpentine type pattern, with about twenty-seven (27) inches center to center between rows. There shall be enough rows to cover the bottom of each tank. The coils shall be located about six (6) inches above the bottom of the tank. See Section 74 of the Technical Specification for dielectric isolation requirements.

The system shall be subdivided into zones with isolation of each zone possible for maintenance, without disrupting service to the other zones. A high level of system isolation shall be provided with all heaters having readily accessible isolation stop valves.

60.7 EQUIPMENT HEATERS AND CONTROLS

60.7.1 Hot Water Heater Coils

Re-heaters and pre-heaters for ductwork are described in Section 12 of the Technical Specification. Hot water flow through duct mounted heaters shall be controlled as describe in Section 12 of the Technical Specification. Thermostats for controlling the modulating valves shall be provided in the ductwork or compartment served as described in Section 12 of the Technical Specification.

60.7.2 Hot Water Convectors

Convectors shall be hot water supplied and are described in Section 12 of the Technical Specification.

60.7.3 Hot Water Unit Heaters

Unit heaters are described in Section 12 of the Technical Specification. Hot water flow through unit heaters shall be controlled as described in Section 12 of the Technical Specification.

60.7.4 Potable Water Heat Exchangers

The dual walled heat exchanger for heating potable water is described in Section 59 of the Technical Specification. Heating water flow through the heat exchanger shall be controlled with 2-way or 3-way modulating, temperature adjustable valves.

60.7.5 Main Engine Jacket Water Keep-Warm Heaters

The heat exchangers for heating engine keep-warm heaters are OFE PSI Contractor and described in Section 59 of the Technical Specification and **VOLUME V**, *OWNER'S FURNISHED EQUIPMENT*. Heating water flow through heat exchangers shall be controlled with globe type balancing valves.

60.8 SPARE PARTS AND INSTRUCTION MANUALS

Provide a list of recommended spare parts and special tools for those items which are Contractor furnished, together with parts lists and instruction manuals necessary to maintain and service provided equipment and accessories in accordance with the requirements of Sections 86 and 100 of the Technical Specification.

60.9 TESTS, TRIALS AND INSPECTIONS

Test and/or trials shall be provided in accordance with this Section and Section 101 of the Technical Specification.

Inspections shall be performed as defined in this Section and Section 1 of the Technical Specification.

60.10 PHASE II TECHNICAL PROPOSAL REQUIREMENTS

The following calculations, in addition to other deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase II Technical Proposal stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Piping System Calculations – Hot Water Heating System

B. Hot Water System Heating Capacity Calculations (to determine the sizes of the various heat exchangers, coils, etc.)

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

60.11 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS

The following calculations, in addition to other deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase III Detail Design stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Piping System Calculations - Hot Water Heating System

B. Hot Water Heating System Capacity Calculations

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

(END OF SECTION)